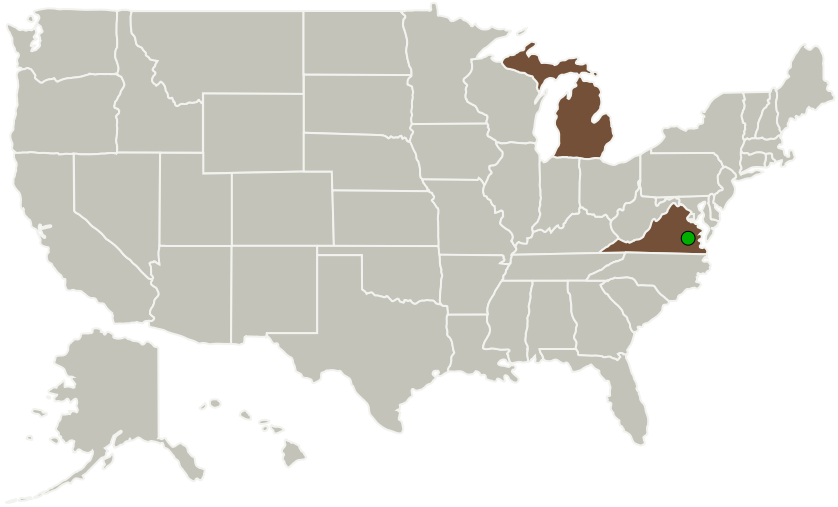
Differential Terahertz Imaging Methods for Enhanced Detection of Subsurface Features, Flaws, and Damage, Phase II

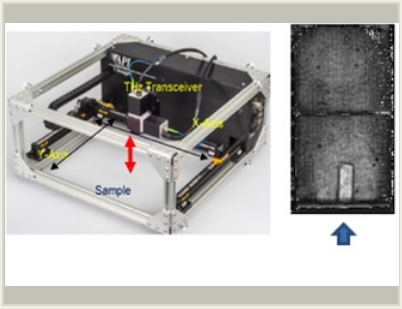
Completed Technology Project (2017 - 2019)

Project Introduction

In Phase II, Picometrix proposes to design, construct, test, characterize, and deliver a prototype differential time domain terahertz shearographic imaging system. The differential imaging methods developed in Phase I will be improved and the methods implemented in turn-key software and hardware. In Phase I the feasibility of using differential time domain THz imaging methods to enhance the contrast and detectability of features such as disbonds was demonstrated. Kissing disbonds and cracks may only weakly reflect the THz pulses in conventional THz imaging. The Phase I project developed the methods of shearographic loading of the samples, and used penetrating THz pulses to detect the subsurface deformation of the defects with better contrast than traditional THz imaging. In a disbond there is a region where the two sides of the material are not adhered, and the space between the two sides are essentially so close that THz interface reflection pulses from the non-adhered region may be partially cancelled out.. The defect signature may be only weakly detectable compared to when the spacing is greater than the minimum THz wavelength. The differential images null background clutter and highlight the subsurface distortion of the defects under loading.

Primary U.S. Work Locations and Key Partners





Differential Terahertz Imaging Methods for Enhanced Detection of Subsurface Features, Flaws, and Damage, Phase II Briefing Chart Image

Table of Contents

Differential Terahertz Imaging Methods for Enhanced Detection of Subsurface Features, Flaws, and Damage, Phase II

Completed Technology Project (2017 - 2019)

Organizations Performing Work	Role	Type	Location
Picometrix, LLC	Lead Organization	Industry	Ann Arbor, Michigan
Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations	
Michigan	Virginia

Project Transitions

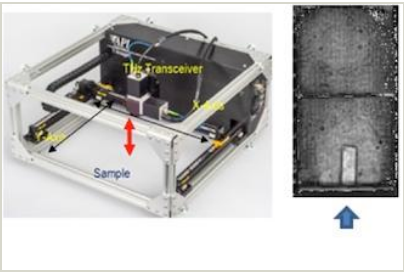
April 2017: Project Start

April 2019: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/141067)*

Images



Briefing Chart Image
Differential Terahertz Imaging Methods for Enhanced Detection of Subsurface Features, Flaws, and Damage, Phase II Briefing Chart Image
(https://techport.nasa.gov/image/132911)

Final Summary Chart Image
Differential Terahertz Imaging Methods for Enhanced Detection of Subsurface Features, Flaws, and Damage, Phase II
(https://techport.nasa.gov/image/125852)

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Picometrix, LLC

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

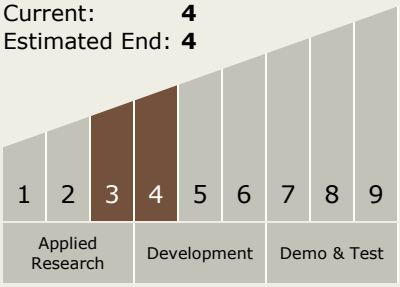
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Shirley Evans

Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**



Differential Terahertz Imaging Methods for Enhanced Detection of Subsurface Features, Flaws, and Damage, Phase II

Completed Technology Project (2017 - 2019)

Technology Areas

Primary:

- TX13 Ground, Test, and Surface Systems
  - TX13.2 Test and Qualification
    - TX13.2.2 Propulsion, Exhaust, and Propellant Management

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System